Energy Research and Development Division
FINAL PROJECT REPORT

Sonoma County RESCO

Renewable-Based Energy Secure Communities — Sonoma County

Prepared for: California Energy Commission
Prepared by: Sonoma County Water Agency

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PREFACE

The California Energy Commission Public Interest Energy Research (PIER) Program supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

The PIER Program conducts public interest research, development, and demonstration (RD&D) projects to benefit California.

The PIER Program strives to conduct the most promising public interest energy research by partnering with RD&D entities, including individuals, businesses, utilities, and public or private research institutions.

PIER funding efforts are focused on the following RD&D program areas:

- Buildings End-Use Energy Efficiency
- Energy Innovations Small Grants
- Energy-Related Environmental Research
- Energy Systems Integration
- Environmentally Preferred Advanced Generation
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy Technologies
- Transportation

Renewable-Based Energy Secure Communities - Sonoma County is the final report for the Renewable Energy Secure Sonoma County project (PIR-08-038) conducted by the Sonoma County Water Agency. The information from this project contributes to PIER's Renewable Energy Technologies Program.

For more information about the PIER Program, please visit the Energy Commission's website at www.energy.ca.gov/research/ or contact the Energy Commission at 916-327-1551.

ABSTRACT

In 2005, Sonoma County adopted one of the boldest community greenhouse gas reduction target in the nation – 25 percent below 1990 levels by 2015. As a Renewable-Based Energy Secure Community (RESCO), Sonoma County produced the Community Climate Action Plan providing a blueprint to achieve this ambitious goal. Central to the plan is developing a renewable energy sources within the county. This report summarizes the Sonoma County RESCO project to develop a locally owned, cost-effective renewable energy portfolio ready to implement. The project team included the data collection and analysis for designing the prototype portfolio, developed an integrated renewable energy demonstration pilot microgrid project, performed an analysis of related greenhouse gas reductions, explored the financial mechanisms for constructing the portfolio, and designed a governance structure for managing the envisioned public works project.

The project also presents a localized energy infrastructure model. The model showed that Sonoma County can meet a large portion of its forecasted electricity demand through developing local distributed and small scale renewables, combined heat and power, biomass, and reducing demand with energy efficiency. This effort required substantial participation from the private sector and the right financing structures. Local renewable-based energy resources could be developed through a more comprehensive locally controlled community choice aggregation program, or other similar program. The cost-effectiveness of meeting this demand is likely to improve over time as the costs of wholesale energy and corresponding retail electric rates increase.

Keywords: RESCO, Sonoma County Water Agency, Action Plan, renewable energy, portfolio, local government, community choice aggregation, CLEAR model, pilot project, wind, geothermal heat pumps, biogas, digester, solar photovoltaics, electric vehicles, charging stations, GHG emissions

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EXECUTIVE SUMMARY

Introduction

Sonoma County has made groundbreaking progress at the local level toward achieving the Renewable-Based Energy Secure Communities (RESCO) vision. In 2005, nine cities and the County adopted one of the boldest community greenhouse gas reduction target in the nation - 25 percent below 1990 levels by 2015. In 2008, the Sonoma County Community Climate Action Plan (CCAP) was released by the Climate Protection Campaign to provide a blueprint for achieving the County's greenhouse gas reduction target. A central component of the CCAP was an integrated, community-scale renewable energy portfolio.

The renewable energy portfolio in the CCAP was prepared based on publicly available aggregate energy and carbon emissions. This provided the basis for preparation of a carbon model that could be used to design a proposed new energy infrastructure to serve Sonoma County communities. This RESCO project uses a more accurate data set to refine the renewable energy portfolio model that was developed and to calculate the price-competitiveness and carbon impacts of the proposed infrastructure.

Purpose

This project helped prepare Sonoma County to implement a locally owned, cost-effective Renewable Energy portfolio. This required detailed data analysis to design the Renewable Energy prototype portfolio, develop an integrated Renewable Energy pilot microgrid project, and prepare an analysis of related greenhouse gas (GHG) emission reductions, a model of estimated economic impacts, and a governance structure for managing the renewable energy deployment envisioned.

The outcomes of this project include:

- Three Renewable Energy portfolio scenarios using the CCAP as a base case.
- The description of the methodology to develop the three Renewable Energy portfolio scenarios.
- A systems model predicting the GHG reductions and economic impacts of the three scenarios, which could be exported and customized to other regions developing RESCOs.
- A pilot project demonstrating small wind, geothermal pond heat exchange, and electric vehicle charging stations.
- Lessons learned in attempting to develop Renewable Energy projects and an integrated, co-located, Renewable Energy portfolio, including discussions of why a poultry manure digester gas to energy project did not get implemented.
- An evaluation of the potential to establish a Community Choice Aggregation power procurement entity in Sonoma County, including a summary of potential environmental, financial, regulatory and socio-political barriers.
- An investigation of governance structures appropriate to Sonoma County to manage deploying the Renewable Energy portfolios developed.

Project Results and Recommendations

Data Collection

PG&E could not provide any data not covered by its Schedule E Community Choice Aggregations INFO Tariff[1]. The project team recommended that PG&E's tariff should be changed to allow for (1) permanent real-time 24/7 data access to PG&E's entire database for every meter and measuring device in or near Sonoma County; (2) any form of data including the entire contents of the PG&E database, at cost; and, (3) natural gas data to the greatest detail allowed by law and regulation. The California Public Utilities Commission has since adopted a decision mandating utilities to provide necessary data as requested by any community exploring Community Choice Aggregation. [2]

It is recommended that the following general guidelines for data collection by local California governments from their local utility be considered:

- Use a consultant familiar with California Public Utilities Commission regulations, regarding Community Choice Aggregation data access as well as PG&E's Community Choice Aggregation -INFO tariff data request protocol.
- Organize the data collection strategy around analysis of the local investor-owned utility's Community Choice Aggregation data tariff.
- Make two separate requests to the investor-owned utility. The first request should include only the Community Choice Aggregation -INFO tariff data. The second request should cover remaining data.
- Have an attorney present during negotiations on data requests.
- Keep written record of all communications and use registered mail for all paper correspondence.
- Select a data specialist as the main contact point for negotiation.
- Assume a lengthy (i.e., six-month to one-year) turnaround for Community Choice Aggregation -INFO tariff data, and one to three years for non-tariff PG&E data.

For best results, a survey of available utility data (starting at the state level) should be done in advance. Once a survey is completed of countywide data available from government entities, a more customized approach to identifying city-specific data can be undertaken.

Renewable Energy Portfolio Design

The Renewable Energy Portfolio Design scenarios refined the first portfolio presented in the original Sonoma County Community Climate Action Plan. The study compared three new

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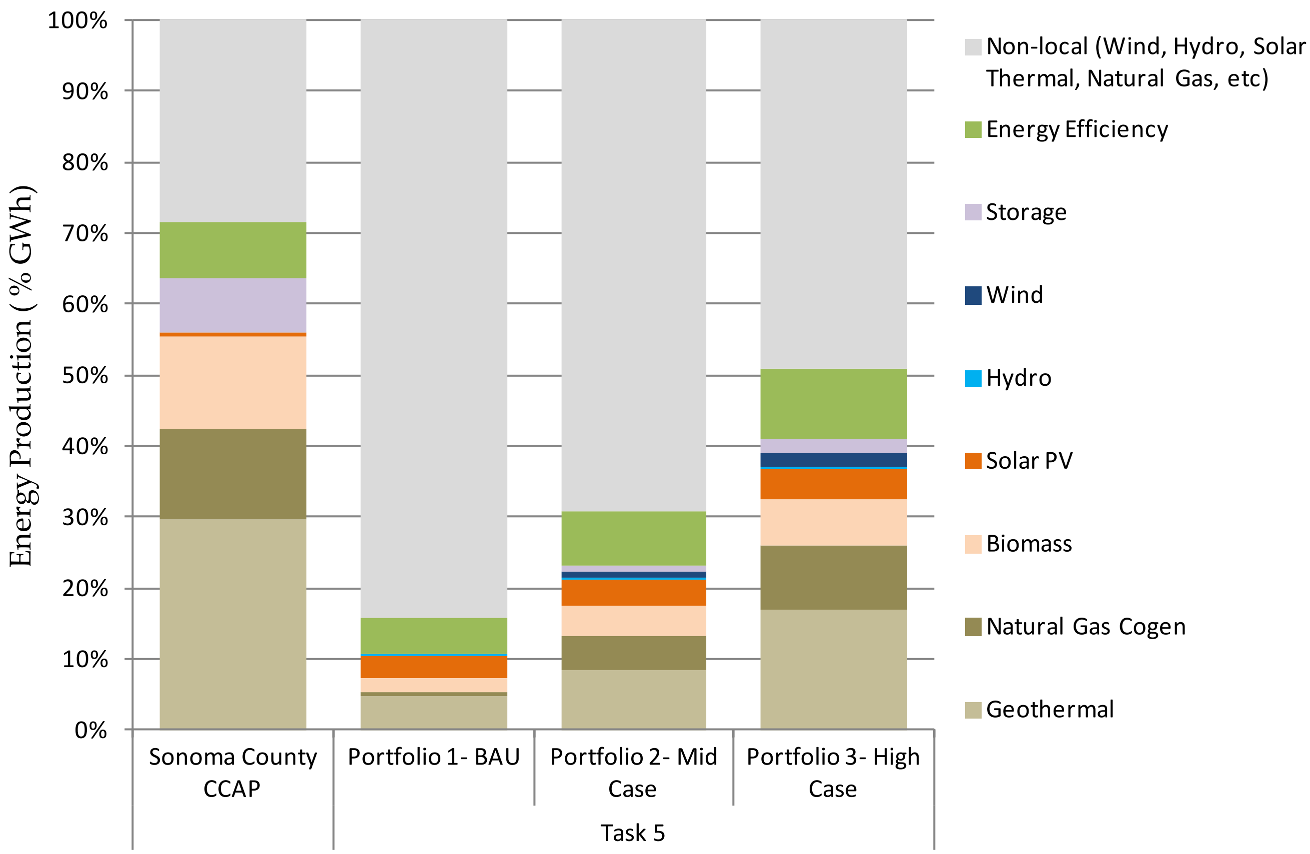
[1] https://www.google.com/?gws_rd=ssl#q=Schedule+E+Community+Choice+Aggregation+CCA-INFO+tariff

[2] http://docs.cpuc.ca.gov/published/Final_decision/160206-02.htm#TopOfPage. [(6) An electric corporation shall provide access to utility information, rates and services to community choice aggregators on the same terms as it does for its independent marketing division. (See D.97-12-088, App. A, Part III.B.1.)]

refined renewable energy portfolios against the original Community Climate Action Plan (excluding energy efficiency) (Figure 1).

Figure 1: Renewable Energy Portfolio Scenario Refinement



Recommendations for increasing the amount of local renewable energy include:

- Establishing a community choice aggregation program, or similar program, to provide planning and financial tools to implement portfolios with high penetration of cost effective local resources.
- Implementing financial tools, such as on-bill financing, feed in tariffs based on market conditions instead of a flat or average rate, and low interest loans, to expand installing energy efficiency and on-site distributed generation behind the meter.
- Removing restrictions that prevent biomethane in natural gas transmission pipelines to qualify as a renewable energy resource, which would improve the cost-effectiveness, flexibility, and efficiency of using this fuel.

Pilot Project Demonstrations

Farms to Fuel[3] - Due to unforeseen barriers, the Farms to Fuel project was not completed in the term of the Water Agency/Energy Commission RESCO contract. However, the barriers

[3] http://www.scwa.ca.gov/farms-to-fuel/

experienced for Farms to Fuel are documented and should be used as lessons learned and considered before implementing similar projects within the state. The barriers included restricted and suspended financial incentives, environmental mitigation costs and timeframes, and financial market hesitation.[4]

Though Farms to Fuel was not constructed in Sonoma County within the timeframe of the RESCO project, there is still valuable information to be gained from the early stages of the project which was carried out with other funding sources. A small scale Farms to Fuel test project constructed in Missouri demonstrated that the thermophilic anaerobic digestion process and fertilizer production is a viable means ofconverting chicken manure into useful product.

Wind Turbine - Careful selection and scrutiny of wind turbine and performance is essential to deliver a project that meets energy production claims. Timely implementation of a project application and approval under rebate incentive programs must also occur to ensure that any rebates included in a cost effectiveness model are actually realized. In addition, it is advisable to follow practices and guidelines to implement large land-based wind systems when implementing small wind systems, such as conduct an avian and bat survey to determine potential impacts prior to selecting a site.

Geothermal Pond Loop - Site selection for geothermal heat exchange projects should either have an existing water source in very close proximity or a large area of land that can be used for vertical drilling or horizontal layout of piping. The site should also have high heating and cooling loads for the geothermal system to be cost effective.

Conclusions

Sonoma County can meet a large portion of its forecasted electricity demand through development of local distributed and small scale renewables, combined heat and power, biomass, and demand reduction resources such as energy efficiency, with substantial participation from the private sector and application of the right financing structures. Local renewable-based energy resources could be developed through a more comprehensive locally controlled community choice aggregation program, or other similar program. The cost-effectiveness of meeting this demand is likely to improve over time as the costs of wholesale energy and corresponding retail electric rates increase.

While the goal of this project was to develop a renewable energy portfolio that is refined from the Sonoma County Climate Action Plan portfolio for implementation, barriers were encountered that required further actions to move this renewable energy portfolio to an advanced stage.

Benefits to California

The Sonoma County RESCO project further investigates and provides leadership in implementing local, efficient, integrated, distributed renewable energy-based electricity that can drive actual projects to emerge and increase in presence on the electrical grid.

[4] http://www.energy.ca.gov/business_meetings/2011_packets/2011-06-29/Item_16_BioStar/Item_16_BioStar.pdf

The Sonoma County RESCO project presents a new, localized energy infrastructure model that provides environmental and economic benefits for California's electric rate payers to:

- Protect against rising cost of electricity for utility customers on a long-term basis.
- Help to stabilize rates in the midterm.
- Provide local economic development and jobs.
- Expand private enterprise opportunity in the energy sector.
- Enhance local energy security and independence.
- Increase local control and community participation.
- Offer a model to help achieve California's greenhouse gas emission reduction goals.

The systems model developed for this project can also be used as a tool for other local communities. The model user interface and the particular modeling approach supports policy makers and stakeholders in making decisions to implement climate change mitigation actions.

CHAPTER 1:
Project Summary and Approach

1.1 Background and Team Formation

In 2005, Sonoma County adopted the boldest community greenhouse gas reduction target in the nation – 25% below 1990 levels by 2015. The Community Climate Action Plan, produced by the Climate Protection Campaign (CPC), a partner on this Renewable Energy Secure Communities (RESCO) project for Sonoma County, provides a blueprint for achieving this ambitious goal. Central to the plan is the development of renewable energy sources within the county.

Concurrently in 2006, the Sonoma County Water Agency (Water Agency) began exploring the concept of Carbon Free Water by 2015, with the goal of operating a net carbon free energy supply for the water system by 2015. The Water Agency is among the Sonoma County's largest users of electricity. The pumping and distribution of potable water to more than 600,000 Sonoma and Marin County residents takes large amounts of electrical power, as does treatment processes in the Water Agency's sanitation facilities.

The Water Agency's Energy Policy has been the guiding document for its energy-related efforts and the framework behind the Carbon Free by 2015 Program. The Water Agency has been using this policy since 2006 and it was formally adopted by its Board of Directors on March 22, 2011. The Energy Policy includes participating in projects of regional benefit as described below:

- **Projects of Regional Benefit** -The Agency will continue to seek and develop more reliable sources of electricity for the region, including participating in local energy projects and programs that promote self-sufficiency and make North Bay residents less dependent on outside energy sources subject to market fluctuations, natural disasters, and transmission system failures. To accomplish this, the Agency will seek to work with partners, such as the County of Sonoma and other local jurisdictions.

As part of this policy, the Water Agency Board of Directors authorized the Water Agency to submit an application for the California Energy Commission's RESCO grant program in February 2009. The Board of Directors also authorized the Water Agency to enter into necessary contractual agreements with the Energy Commission and Water Agency subcontractors. The Water Agency entered into a contractual agreement with Energy Commission in August 2009. The last of the Water Agency's subcontractor agreements was finalized in February 2010. Water Agency subcontractors for the project include Los Alamos National Laboratories (LANL), Climate Protection Campaign (CPC), and Regional Climate Protection Authority (RCPA).

1.2 Goals and Objectives

The renewable energy portfolio in the CCAP was prepared based on publicly available aggregate energy and carbon emissions. This provided the basis for preparation of a carbon assessment that could be used to design a proposed new energy infrastructure to serve Sonoma County communities. This RESCO project uses a more accurate data set to refine the renewable energy portfolio model that was developed and to calculate the price-competitiveness and carbon impacts of the proposed infrastructure.

The scope of the Sonoma County RESCO project is to prepare detailed data analysis for designing a Renewable Energy (RE) portfolio, the development of an integrated RE portfolio, modeling and analysis of the greenhouse gas reductions emissions associated with the RE portfolio, an exploration of the financial mechanisms for cost effective construction of the portfolio, and a governance structure most suitable for implementing the RE portfolio envisioned.

The ultimate goal of this project is to develop and partially demonstrate a model for a locally owned, cost-effective renewable energy (RE) portfolio that helps Sonoma County meet its greenhouse gas reduction goals.

The objectives of the project include:

- Proposed suite of resources that produce cost-effective renewable energy for Sonoma County
- Proposal for a governance and financing structure to implement the system as a community controlled project
- Computer model that describes greenhouse gas (GHG) impacts, costs, and jobs created
- Pilot project demonstrating RESCO principles: integrated, distributed, community-scale

1.3 Approach

The Sonoma County RESCO team collected energy data from various sources including confidential and non-confidential community choice aggregation tariff data from the local utility. The team collected available data from public, local, and state governments including utility and public infrastructure data, physical geographic data, zoning, permitting, and planning data.

The data collected was integrated and analyzed, and identified energy use patterns and proposed approaches to developing locally derived renewable energy projects in Sonoma County. The RESCO team developed and analyzed RE portfolio scenarios and refined a prototype based on local energy use patterns.

LANL developed The Climate Energy Assessment for Resiliency (CLEAR) systems dynamics model that analyzed the RE portfolio scenarios in terms of natural, built, and social systems. The model helped assess the RE portfolio scenarios and provided understanding of the interrelationship of energy use, greenhouse emissions, financial and economic impacts.

The Water Agency developed small-scale pilot demonstration renewable energy projects corresponding with technologies in the RE portfolio scenarios. The pilot projects helped test the local effectiveness of a cogeneration plant fueled with geothermal heat pumps using recycled water ponds, small wind turbines, and electric vehicle charging stations.

A communications plan was implemented to provide progress updates, increase familiarity with the project, look for potential synergies, and prepare for eventual implementation of the RE portfolio.

The RESCO team explored governance options for implementation of the Sonoma County RESCO, and collected relevant models from other regions.

A technology transfer element was incorporated to disseminate the findings of the project to other communities. As part of this, a project website was developed at: http://www.sonomaresco.org.

1.3.1 Tasks

The approach for the project followed the Tasks identified in the Sonoma County RESCO project scope. The tasks are described below:

Task 1 Administration

- Kickoff meeting, CPR meetings, final meeting, monthly progress reports, final report, indentify & obtain matching funds, identify & obtain required permits

Task 2 Communication and Coordination Tasks

- Communication with Local Government & Stakeholders, RE portfolio design and SD modeling coordination

Task 3 Data Collection

- Collect data from PG&E for Sonoma County public and private sources that relate to RE deployment

Task 4 Data Integration and pre-analysis report generation

- Analyze and integrate data from Task 3 to identify resource potential, demand profiles, data protocol, economics of implementation, neighborhood and municipality usage patterns.

Task 5 Analysis and Modeling

- Develop and analyze RE portfolio scenarios and refine a prototype based on local energy use patterns.

Task 6 System Dynamics Modeling

- Develop an integrated assessment framework (SD Model). The model will incorporate industry specific sectors and consider social, economic and environmental impacts and interrelationships.

Task 7 Pilot Project Design

- Develop and design a pilot project to demonstrate mix of RE technologies. Calculate energy saving and emissions reduction and document cost-effectiveness.

Task 8 Pilot Project Construction and Performance Evaluation

- Build, operate, monitor and evaluate the performance of the demonstration pilot project.

Task 9 Establish Governance Structure

- Develop, recommend, and establish the governance structure and practices for local RE construction and operation and identify best practices governing approach. Use existing governance structures and input from experts and stakeholders to inform recommended structure.

Task 10 Technology Transfer

- Develop a plan to make the knowledge gained, experimental results and lessons learned available to the public and key decision makers.

CHAPTER 2:
Communication Plan

2.1 Scope

The goal of this task was to insure that local government and agency representatives and staff were apprised of the RESCO project progress decision points in a timely, efficient and coordinated manner, and to facilitate communication and data transfer between local government and other stakeholders.

2.2 Plan

The Communications Plan ensured that RESCO Team members maintained consistent coordination of activities throughout the duration of the project. It also ensured that elected officials, governmental agency representatives, and staff were apprised of the RESCO project progress and decision points in a timely, efficient and coordinated manner, and facilitated communication between local governments, agencies, and other stakeholders. Local government in this case included all nine cities within Sonoma County, and the County of Sonoma. Stakeholders included:

- Businesses
- Industry
- Government
- Labor
- Nonprofit organizations
- Schools and universities
- Elected officials
- Other community leaders, and the general public

The Communications Plan was used to:

1. Coordinate activities and share information among research team members
2. Share information with County governments and stakeholders.
3. Convene policymakers and other stakeholders
4. Offer workshops and study sessions on topics and for participants

The Communications Plan is shown in Appendix A.

CHAPTER 3:
Governance Structure

3.1 Scope

The goal of this task was to develop, recommend, and establish the governance structure and practices for local RE construction and operation and identify the best approach to governing such an effort.

The Governance Structure Report is shown in Appendix B.

3.2 CCA Evolution

Simultaneous to the Sonoma RESCO project, a Sonoma County Community Choice Aggregation (CCA) renewable energy program was being explored. Feasibility studies, steering committee meetings and public meetings with City Councils and Board of Supervisors were and continue to be conducted. Based on the research team's assessment and analysis of the various ownership models, a CCA model would provide a viable option to public oversight of procurement of renewable energy and development of local renewable energy generation.

A CCA is an ownership model which allows cities and counties to aggregate the electricity buying power (electric load) of residential, business, and institutional customers within a jurisdiction and provide electricity to those customers by accessing the wholesale energy market and entering into contracts for electric power generation. This arrangement could be used to procure energy supply contracts with increased renewable energy content. A CCA differs from a municipal utility in that it does not own or maintain transmission and distribution infrastructure, it relies on the existing Investor Owned Utility (IOU) to deliver the electricity and serve the electrical power system.

Community Choice Aggregation has the benefits of both local control over the energy resources used by the community and the potential to provide electricity to customers at a lower overall cost. Another benefit is the increased capacity for local stakeholders to influence energy policy. CCA is a viable option to fulfill Sonoma County's renewable energy goals of local control, cost effectiveness, and reduction of greenhouse gas emissions.

The RESCO research team's assessment and analysis of the various ownership models and governance structures helped to inform the CCA discussion that has been happening simultaneously within the County. It was determined by local policymakers that CCA was a potential viable option to public oversight of procurement of renewable energy and development of local renewable energy generation and thus worth further exploration. As for the exact governance structure of the CCA, policy maker discussions are on-going and will address key issues such as: membership, voting, procurement and administration.

3.2.1 Local Policymaker decisions

Local policymakers made four pertinent decisions during the RESCO project:

- On March 22, 2011 the Board of Directors for the Sonoma County Water Agency authorized the preparation of a Feasibility Study for a Sonoma County CCA program.

That study was completed by Delessi Management Consultants in October of 2011 and found that CCA is feasible for Sonoma County.

- On October 18, 2011 the Board of Directors for the Sonoma County Water Agency authorized staff to engage in further study of CCA for Sonoma County, and named the program Sonoma Clean Power.
- On April 10, 2012 the Board of Directors for the Sonoma County Water Agency authorized staff to produce an Implementation Plan for a Sonoma County CCA and to begin the process of forming a Joint Powers Authority to administer the program.
- On December 4, 2012 the Sonoma County Board of Supervisors and Board of Directors of the Sonoma County Water Agency signed a Joint Powers Agreement creating the Sonoma Clean Power Authority, and authorize County Counsel to file the notice required by Government Code section 6503.5 with the Secretary of State. At the same meeting, the Board appointed the five members of the Board of Supervisors and Board of Directors of the Water Agency as directors of the Sonoma Clean Power Authority Another action was adopting a Resolution introducing, reading the title of, and waiving further reading of an ordinance entitled "An ordinance of the Board of Supervisors of the County of Sonoma, State of California and an ordinance of the Board of Directors of the Sonoma County Water Agency, authorizing the implementation of a Community Choice Aggregation Program.

Additional Policymaker decisions are documented in Appendix A.

CHAPTER 4:
Collect, Integrate, Analyze Data

4.1 Scope

The goal of this task was to complete government agency and Pacific Gas and Electric (PG&E) data collection for Sonoma County and gather any available data for purposes of analysis, modeling and preparation of a prototype RE portfolio design. The data was analyzed and integrated to assess customer load profiles in various regions around the county.

4.2 Local Zoning and Utilities, Power Utility, State Data

Data was collected from Sonoma County's investor-owned utility, PG&E, as well as local, state, and federal government agencies.

The data collection was designed to provide an enhanced analysis of regional energy demand, design replacement infrastructure, configure technologies, choose locations, and design efficient and cost-effective applications.

PG&E data was then collected. Recent California law has created an unprecedented opportunity for local governments designing and preparing to implement Climate Action Plans to enjoy a privileged level of access to highly granular regional electricity use data from their incumbent electricity utilities. Data available includes detailed and complete databases of customer-specific as well as aggregate and climate-based energy use data, including retail power meter data which is carefully protected confidential customer information formerly limited to the power company and its consultants. The legal authority to collect monthly and in some cases interval time-of-use power meter data provided Sonoma County with the opportunity to obtain this detailed data.

Data was requested from local government agencies to determine what data they had available in electronic format (GIS or standard database format). The general objectives of the local data requests were to:

- Identify existing energy infrastructure considerations
- Obtain geographic information to evaluate resource availability
- Obtain site-specific information required for locating resource types such as wind, solar (thermal and photovoltaic), biomass, small scale hydro, wave/tidal, landfill gas and storage technologies such as pumped hydro and compressed air
- Identify opportunities for specific deployment strategies such as district heating, microgrids and islanding
- Identify legal barriers to development such as permit or zoning restrictions
- Characterize factors influencing the feasibility of resource development such as land ownership, land use regulations and permit jurisdictions

The full Data Collection Report is shown in Appendix C.

4.3 Power Consumption Pattern, Location and Resources

The Sonoma County data collected from PG&E includes monthly reports from approximately 230,000 meters and more frequent interval reports from 20,000 interval meters. The collection of the data involved two years of effort and over a year negotiating with PG&E prior to the actual provision of any data.

Electricity use data was correlated with geospatial information, and a comprehensive database was created in a form usable for Geographic Information System (GIS) processing. The database includes attributes associated with geographic features that may impact the availability or suitability of a given site for development. These attributes include regulatory restrictions, as well as features associated with geography, demand side characteristics, existing infrastructure, and other considerations related to potential renewable energy supply or energy conservation measures on the customer side of the meter.

PG&E charged $22,705 to supply the Sonoma County Water Agency with data for the years 2005, 2006, 2007 and half of 2008. The total number of customers for each year of data provided was:

- 2005: 264,336
- 2006: 261,776
- 2007: 262,614
- 2008: 266,061

The following is a description of the data that was received from PG&E.

Non-Confidential Data:

- Aggregate monthly usage (kWh) by rate schedule and zip code within a city code
- Annual proportional share of energy efficiency funds for a CCA's proposed territory
- System wide residential and nonresidential load shapes by climate band for the most recent year for which PG&E has completed information
- Public Goods Charge customer payment by city code
- Number of service agreements in each rate schedule within a CCA's territory or proposed territory
- Estimated annual generation revenues by CCA territory
- Fitting CCA annual usage to climate band load shapes; estimation of peak coincident and non-coincident demands

Confidential Data:

- Total annual kWh loads of bundled and direct access customers on a monthly basis and secondly on a rate schedule basis within the CCA's territory

- Aggregated residential annual kWh usage for a particular year in a format by tier for each rate schedule
- For the Time of Use (TOU) rates, provide further separation by summer/winter peak, partial peak, and off peak periods and summer/winter period
- Customer-specific information consisting of: service agreement number, name on agreement, service address with zip code, mailing address with zip code, rate schedule, monthly kWh usage, monthly maximum demand where available, and monthly rate schedule for all accounts within the CCA's territory

Data obtained from the data collection was integrated and analyzed in the Data Integration Report found in Appendix D.

The number of data records and the total energy usage for which data was collected in each PG&E rate class in 2007 is shown in Figure 2.

Figure 2: 2007 PG&E Data by Rate Schedule

Rate Schedule	Number of Accounts	Total kWh	Percent of Total Load	Cumulative Percent	Annual Per Account
E1	150,873	947,302,056	34.1%	34.1%	6,278.8
A10S	2,387	377,852,849	13.6%	47.7%	158,296.1
A1	19,715	290,195,116	10.4%	58.1%	14,719.5
E19SV	413	207,409,765	7.5%	65.5%	502,202.8
E1L	29,316	162,779,567	5.9%	71.4%	5,552.6
E19S	57	144,897,114	5.2%	76.6%	2,542,054.6
E20P	12	135,182,773	4.9%	81.5%	11,265,231.1
A10SX	114	94,843,390	3.4%	84.9%	831,959.6
A6	1,184	82,420,344	3.0%	87.8%	69,611.8
E20T	2	54,661,332	2.0%	89.8%	27,330,666.0
E7	4,674	48,427,817	1.7%	91.6%	10,361.1
E8	2,742	42,971,299	1.5%	93.1%	15,671.5
E1TL	68	33,253,307	1.2%	94.3%	489,019.2
AG5B	164	28,044,718	1.0%	95.3%	171,004.4
E20S	4	23,978,390	0.9%	96.2%	5,994,597.5
E19P	10	22,712,620	0.8%	97.0%	2,271,262.0
E1M	959	14,824,867	0.5%	97.5%	15,458.7
AG1A	1,778	12,239,467	0.4%	98.0%	6,883.8
LS2	311	12,041,935	0.4%	98.4%	38,720.0
AG1B	304	8,044,557	0.3%	98.7%	26,462.4
E19PV	6	5,549,521	0.2%	98.9%	924,920.2
E8L	224	3,528,820	0.1%	99.0%	15,753.7
AG5A	108	3,373,617	0.1%	99.1%	31,237.2
E6	315	3,173,232	0.1%	99.2%	10,073.8
AG4B	75	2,961,096	0.1%	99.3%	39,481.3
AG4A	269	2,925,285	0.1%	99.5%	10,874.7
LS1	486	2,816,510	0.1%	99.6%	5,795.3
E7L	234	2,456,057	0.1%	99.6%	10,496.0
TC1	534	1,499,834	0.1%	99.7%	2,808.7
Other	1,048	8,438,374	0.3%		8,051.9
Grand Total	**218,386**	**2,780,805,628**	**100.0%**	**100.0%**	

Residential
Commercial
Agriculture
Government

Where hourly data was available, hourly data was collected for all PG&E accounts across the year. An hourly load profile was developed and imposed across all accounts and is represented in Figure 3. This data shows the yearly peaks occurring in summertime late afternoon/evenings, some winter evening peaks, and a consistent base load occurring throughout the year after midnight and before sunrise. This informs the type of technologies in the RE portfolio that may be required to meet Sonoma County loads throughout the year.

Figure 3: Hourly PG&E Energy Use Pattern Across All Rate Schedules

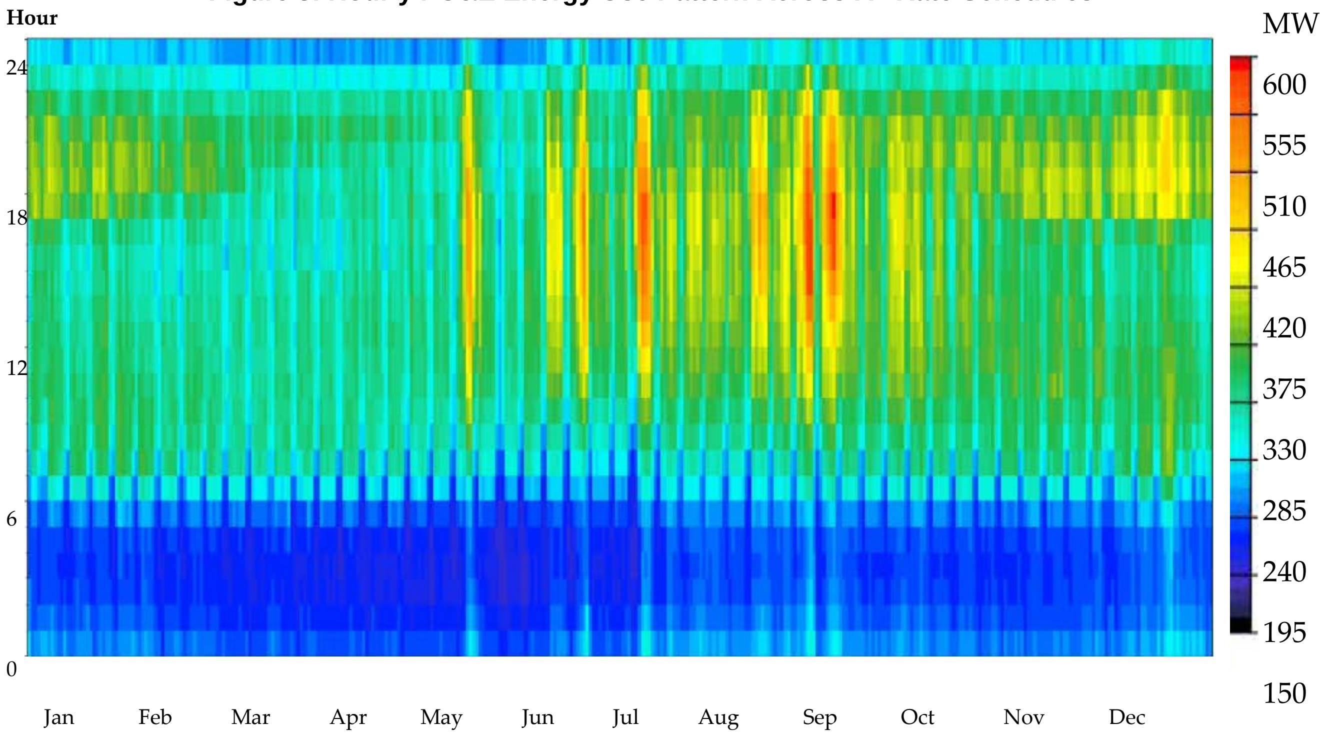


Figure 4 shows the residential, non-residential and total hourly demand during a heat wave in mid-summer.

Figure 4: Peak Summer Week Hourly Demand

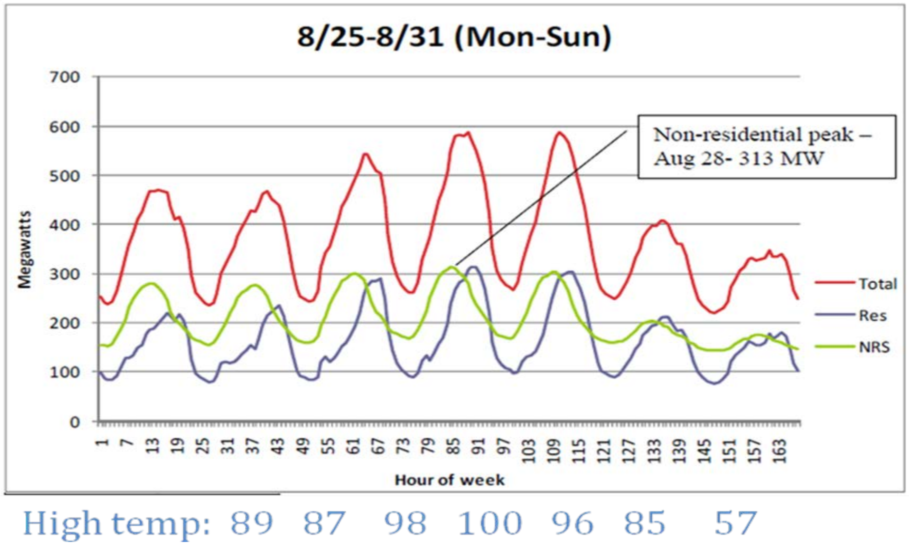


Table 1 shows the minimum and maximum load occurrences for residential, non-residential, and aggregate. The aggregate peak demand load for Sonoma County is around 600 MW. This informs the required capacity of the RE portfolio to meet of the peak demand of Sonoma County.

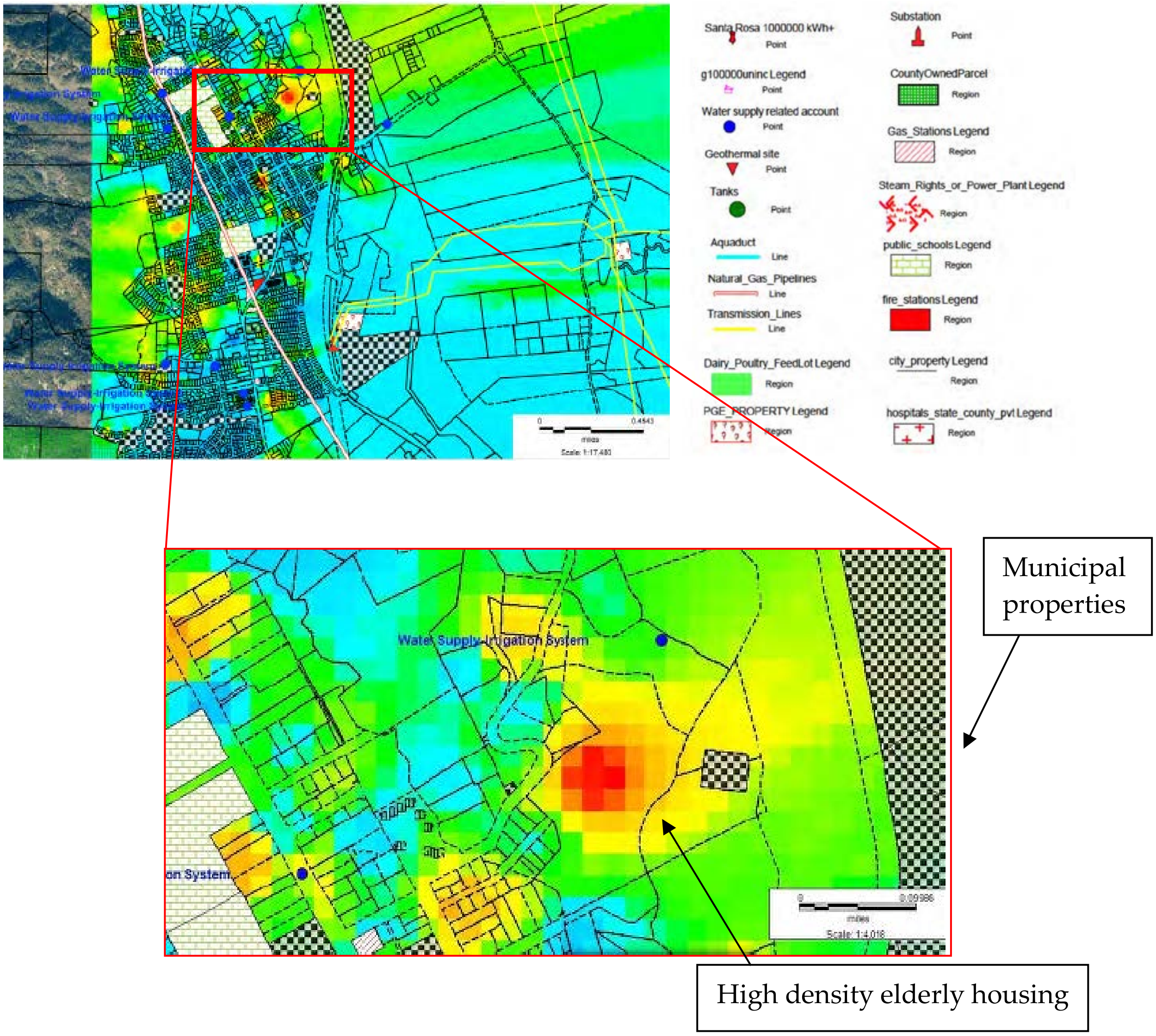
Table 1: Sonoma County Minimum and Maximum Load Occurrences

2008 SONOMA COUNTY Estimated Peak Load for CLIMATE=X			
TYPE	DATE	TIME	LOAD (kW)
Residential minimum	7/22/2008	4:00 AM	70,792
Non-residential minimum	1/1/2008	3:00 AM	117,818
Residential non-coincident maximum	7/8/2008	6:00 PM	331,167
Non-residential non-coincident maxim	8/28/2008	2:00 PM	313,434
Aggregate Annual Maximum	9/5/2008	6:00 PM	593,840

For a higher level of granularity than that of county-wide loads, the research team determined energy use patterns in different neighborhoods and municipalities in Sonoma County using GIS mapping technology.

The map in Figure 5 depicts an example of neighborhood energy density analysis using PG&E meter data and infrastructure and parcel use data provided by local and state governments. The maps are the basis for site evaluation of resource potential and/or demand profile needed to develop a RE portfolio for the County.

Figure 5: Neighborhood Energy Density Analysis



Desirable features of this site are:

- High energy density.
- Adjacent municipally owned property and public rights of way or property with owner willing to participate.
- Presence of campus-like settings with concentrated energy use.
- Simpler optimization of onsite integrated renewable capacity. In order to achieve optimal function, a high level of dispatchability is desired in order for the resource to be available, particularly during the summer peaks.

CHAPTER 5: Analysis and Modeling

5.1 Scope

The goal of this task was to use the PG&E and government agency data collected and the systems dynamics (SD) modeling capability to develop and analyze RE portfolio scenarios to develop a refined prototype.

5.2 RE Portfolio

The original Sonoma County Community Climate Action Plan portfolio was the starting point from which the RE portfolio scenarios were built. Eight resources with the Climate Action Plan were tested and refined. These eight resources are: 1) Efficiency, 2) Solar Photovoltaics (PV), 3) Natural gas combined heat and power (CHP), 4) Geothermal, 5) Biomass, 6) Wind, 7) Hydropower, 8) Energy Storage.

Two other abundant local resources, offshore wind and wave energy, were evaluated, but are not in the local portfolios. These technologies are in early stages of development, with low probability that they can be deployed at significant scale by 2020, or even 2030. Wave energy projects yield wholesale costs between $0.17-$0.22/kWh according to *Wave Power Feasibility Study Report*, URS, prepared for the City and County of San Francisco, December 2009. And unlike San Francisco, Los Angeles and San Diego, the Sonoma County coast lacks dense development and load and has limited transmission and distribution infrastructure.

The RE portfolio resources were examined and analyzed with the following considerations:

- Practicality/Feasibility
- Capital Cost
- Resource Availability
- Resource Policy Goals
- Load Data
- Cost-Effectiveness

Sonoma County could meet a significant portion of its forecasted electricity demand through development of local renewables, combined heat and power, biomass, and demand resources such as energy efficiency. The cost-effectiveness of meeting this demand is likely to increase over time as the cost of wholesale energy and corresponding retail electric rates increase.

Local resources are only a portion of the Sonoma County RE portfolio scenarios. Therefore, remote, large-scale renewable generation and wholesale energy procurement are still needed in the near- to mid-term to support the attainment of Sonoma County's goals for renewable energy development and emission reductions, and to meet the county's electricity demand.

Barriers exist to increasing the amount of local renewable energy that can be supplied. These barriers include factors such as cost and financing, construction time frames, challenges with generation profiles, limits to the architecture of the local distribution grid (for example, capacity bottlenecks), lack of access to high resolution local demand profiles, limits of local resource availability, regulatory and institutional barriers, political challenges, and limited experience in accomplishing high levels of local renewable energy.

The three RE portfolio scenarios modeled and analyzed are (Figures 6-8):

Figure 6: Portfolio 1 Business as Usual (BAU)

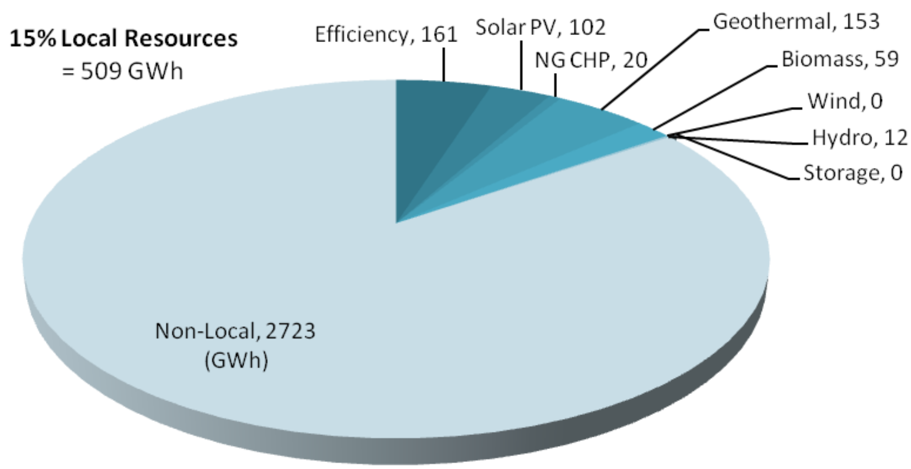


Figure 7: Portfolio 2 Mid-Case (30% Local Resources)

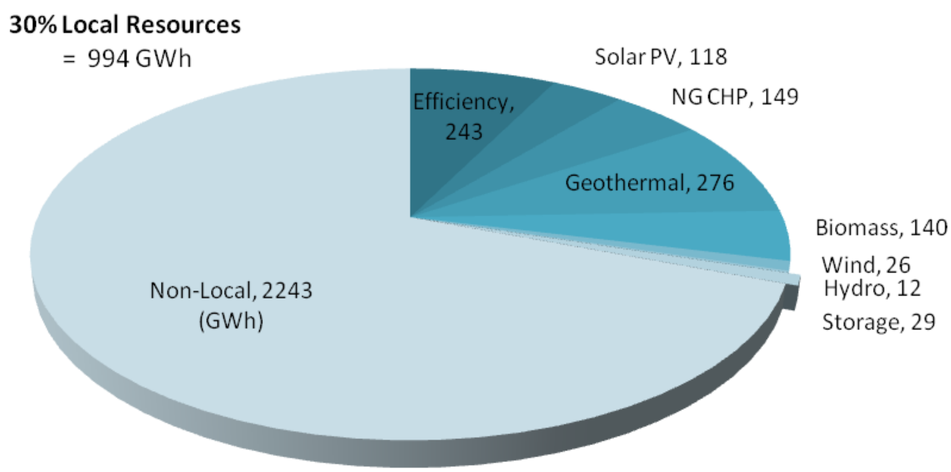


Figure 8: Portfolio 3 High-Case (50% Local Resources)

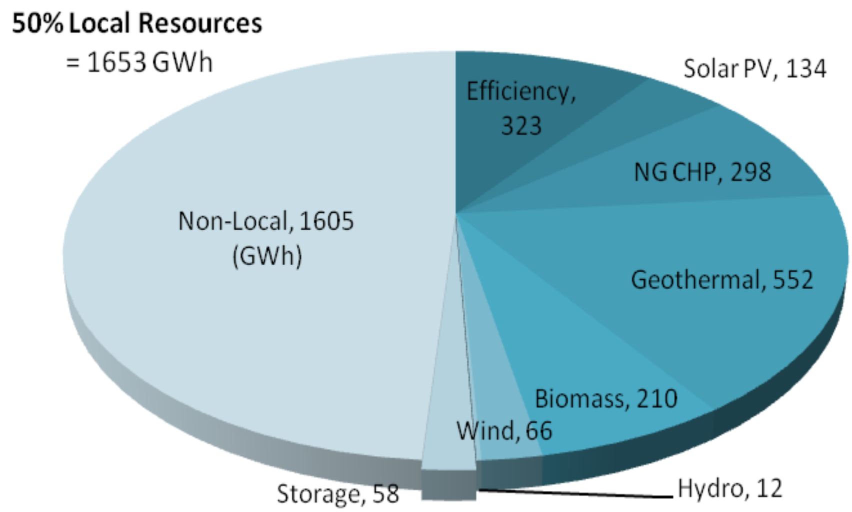
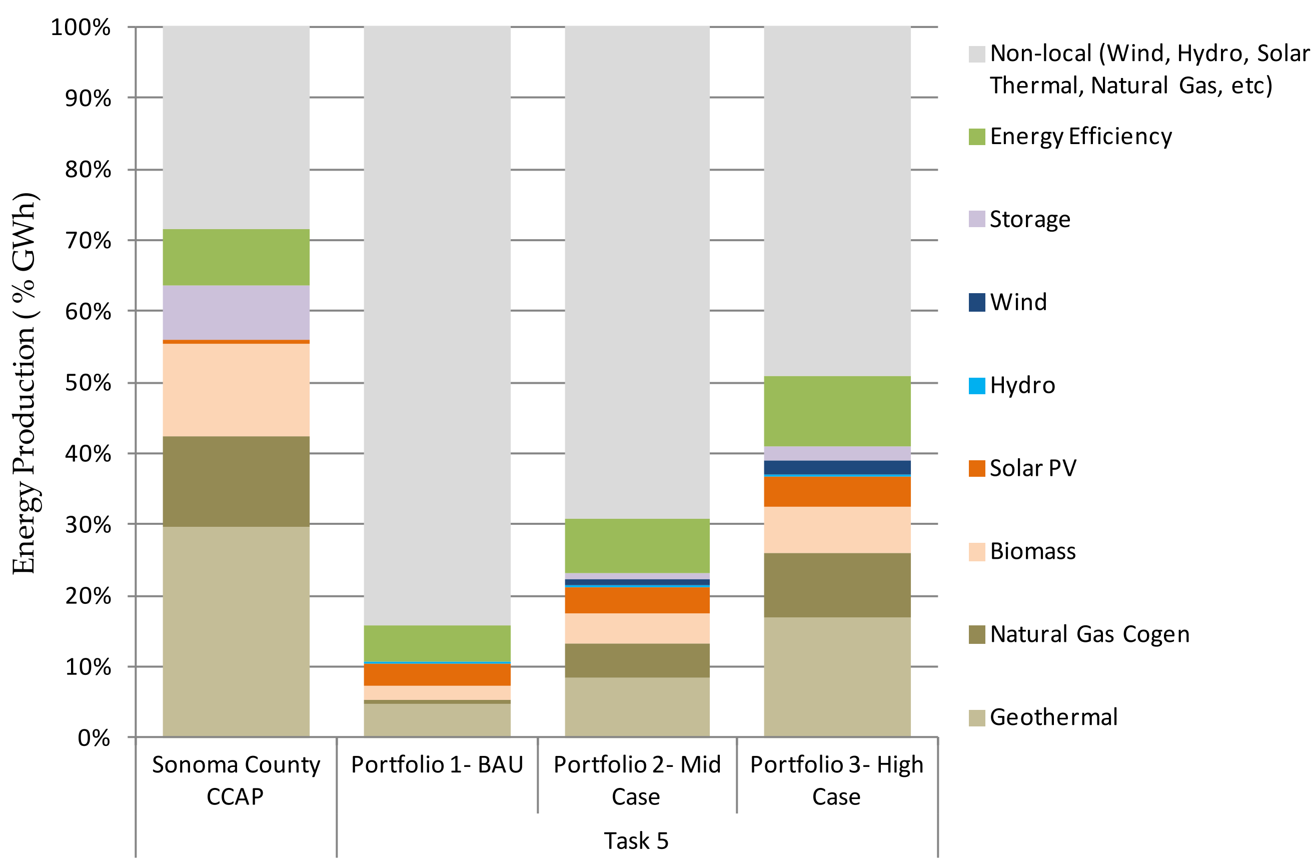


Figure 9 shows the comparison of the refined portfolio scenarios against the Community Climate Action Plan.

Figure 9: Sonoma County Portfolio Refined Capacity



The corresponding proposed deployment schedules of each of the portfolio scenarios are shown in Tables 2-4 as MW capacity and GWh energy production.

Table 2: Portfolio 1 — Low Local Resource/BAU Scenario

	EE	PV	NG CHP	Geothermal	Biomass	Wind	Hydro	Storage	Local
Year	MW	MW	MW	MW	MW	MW	MW	MW	MW
2011	5.1	41.0	2.7	25.0	6.4	0.2	2.8	0.0	83
2012	10.4	45.0	2.7	25.0	6.4	0.2	2.8	0.0	93
2013	15.9	49.0	2.7	25.0	6.4	0.2	2.8	0.0	102
2014	21.6	52.0	2.7	25.0	8.4	0.2	2.8	0.0	113
2015	27.4	55.0	2.7	25.0	8.4	0.2	2.8	0.0	122
2016	33.4	58.0	2.7	25.0	8.4	0.2	2.8	0.0	131
2017	39.6	59.0	2.7	25.0	8.4	0.2	2.8	0.0	138
2018	46.0	61.0	2.7	25.0	8.4	0.2	2.8	0.0	146
2019	52.6	63.0	2.7	25.0	8.4	0.2	2.8	0.0	155
2020	59.5	65.0	2.7	25.0	8.4	0.2	2.8	0.0	164

	EE	PV	NG CHP	Geothermal	Biomass	Wind	Hydro	Storage	Local
Year	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh
2011	14	65	20	153	45	0	12	0	310
2012	28	71	20	153	45	0	12	0	330
2013	43	77	20	153	45	0	12	0	351
2014	59	82	20	153	59	0	12	0	386
2015	74	87	20	153	59	0	12	0	406
2016	91	91	20	153	59	0	12	0	427
2017	108	93	20	153	59	0	12	0	446
2018	125	96	20	153	59	0	12	0	466
2019	143	99	20	153	59	0	12	0	487
2020	161	102	20	153	59	0	12	0	509

Table 3: Portfolio 2 — Mid-Case Scenario

	EE	PV	NG CHP	Geothermal	Biomass	Wind	Hydro	Storage	Local
Year	MW	MW	MW	MW	MW	MW	MW	MW	MW
2011	6.1	41.0	2.7	25.0	6.4	0.2	2.8	0.0	84
2012	12.5	45.0	2.7	25.0	6.4	0.2	2.8	0.0	95
2013	20.3	50.0	2.7	25.0	6.4	0.2	2.8	0.0	107
2014	29.7	55.0	2.7	0.0	8.4	0.2	2.8	0.0	99
2015	40.9	60.0	5.0	0.0	8.4	0.2	2.8	2.5	120
2016	52.3	65.0	7.5	35.0	10.0	2.0	2.8	5.0	180
2017	64.2	67.0	10.0	35.0	12.5	4.0	2.8	7.5	203
2018	77.9	69.0	12.5	35.0	15.0	6.0	2.8	10.0	228
2019	92.1	72.0	15.0	35.0	17.5	8.0	2.8	12.5	255
2020	106.7	75.0	20.0	35.0	20.0	10.0	2.8	15.0	285

	EE	PV	NG CHP	Geothermal	Biomass	Wind	Hydro	Storage	Local
Year	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh
2011	14	65	20	153	45	0	12	0	310
2012	28	71	20	153	45	0	12	0	330
2013	46	79	20	153	45	0	12	0	356
2014	68	87	20	0	59	0	12	0	246
2015	93	95	37	0	59	0	12	5	301
2016	119	102	56	276	70	5	12	10	651
2017	146	106	74	276	88	11	12	14	727
2018	177	109	93	276	105	16	12	19	808
2019	210	114	112	276	123	21	12	24	891
2020	243	118	149	276	140	26	12	29	994

Table 4: Portfolio 3 — High-Case Scenario

Year	EE MW	PV MW	NG CHP MW	Geothermal MW	Biomass MW	Wind MW	Hydro MW	Storage MW	Local MW
2011	6.1	41.0	2.7	25.0	6.4	0.2	2.8	0.0	84
2012	12.5	45.0	2.7	25.0	6.4	0.2	2.8	0.0	95
2013	20.3	50.0	2.7	25.0	6.4	0.2	2.8	0.0	107
2014	30.4	55.0	2.7	0.0	8.4	0.2	2.8	0.0	100
2015	42.9	60.0	5.0	0.0	8.4	0.2	2.8	5.0	124
2016	58.0	65.0	10.0	40.0	10.0	5.0	2.8	10.0	201
2017	75.8	70.0	15.0	40.0	15.0	10.0	2.8	15.0	244
2018	96.4	75.0	20.0	40.0	20.0	15.0	2.8	20.0	289
2019	117.6	80.0	30.0	70.0	25.0	20.0	2.8	25.0	370
2020	142.0	85.0	40.0	70.0	30.0	25.0	2.8	30.0	425

Year	EE GWh	PV GWh	NG CHP GWh	Geothermal GWh	Biomass GWh	Wind GWh	Hydro GWh	Storage GWh	Local GWh
2011	14	65	20	153	45	0	12	0	310
2012	28	71	20	153	45	0	12	0	330
2013	46	79	20	153	45	0	12	0	356
2014	69	87	20	0	59	0	12	0	248
2015	98	95	37	0	59	0	12	10	311
2016	132	102	74	315	70	13	12	19	739
2017	173	110	112	315	105	26	12	29	883
2018	220	118	149	315	140	39	12	39	1032
2019	268	126	223	552	175	53	12	48	1458
2020	323	134	298	552	210	66	12	58	1653

The complete Analysis and Modeling report describing the development of the RE Portfolio scenarios can be found in Appendix E.

5.3 CLEAR System Dynamics Model

5.3.1 CLEAR Model Description

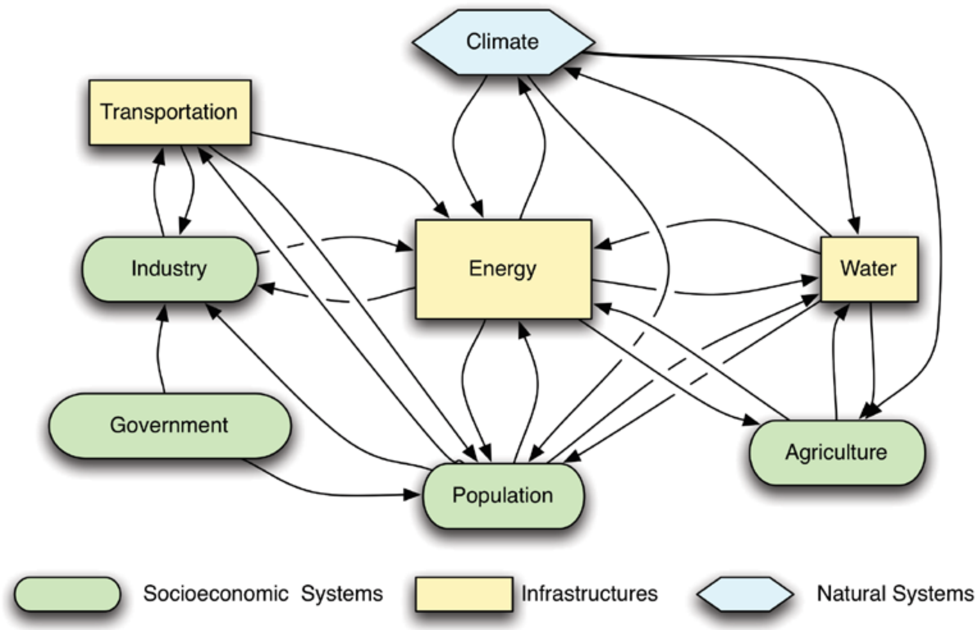
The CLEAR (CLimate-Energy Assessment for Resiliency) model was developed by Los Alamos National Labs (LANL) and was customized for Sonoma County in this project. CLEAR is a model that was designed to assess a wide-range of impacts of climate actions to mitigate green house gas emissions at a County or regional level.

CLEAR is a systems dynamics model that uses a simulation-based framework to help decision makers choose amongst various climate and resource solutions. The model informs the direct and indirect economic, social, and environmental implications of specific climate actions and their behaviors over time.

Focusing on GHG reduction and economic factors, CLEAR models the linkages of the key sectors of society as follows and as shown in Figure 10:

- Energy Sector, which includes electricity and natural gas
- Transportation
- Water supply
- Water waste
- Solid waste
- Agriculture

Figure 10: CLEAR Model Sectors and Linkages



Specific to the project, the CLEAR model assesses benefits and disadvantages of the following measures:

1. Development of a Community Choice Aggregation (CCA) program mostly focused on reforming the electricity supply of the Sonoma County.
2. Investment in water efficiency programs.
3. Incentivize social changes in transportation modes.
4. Improvements of water supply infrastructure.
5. Improvements in the wastewater sector.
6. Improvements in the solid waste sector.
7. Investment in greener agriculture practices.

The integration of sectors and modeling of measures helps to quantify the time behavior of the following impacts:

- Total GHG emissions of the county.
- Impacts on local economy (e.g. employment, salaries, local GDP).
- Economic impacts on the local population (e.g. energy bills, fuel saving).
- Costs associated to implement the climate actions.

The key model outputs used to address these impacts can be characterized in three groups as follows:

- Environmental outputs:
  - GHG emissions reduction
  - Energy saved
  - Water saved
- Economic outputs:
  - Total costs of the taken measures
  - Direct economic impacts to the regional GDP and salaries
  - Indirect economic impacts due to spending of the new jobs in terms of contribution to economic outputs, regional GDP, and salaries
  - Induced impacts on the other economic sectors in terms of economic outputs, GDP, and employment
  - Taxes associated to the actions
  - Energy bills
- Social outputs:
  - Direct labor
  - Indirect labor
  - Induced labor

The CLEAR model uses a web applet interface that enables the user to easily run the model and look at the results of different scenarios in real time. The model can be run at the Sonoma RESCO website http://www.sonomaresco.org by entering proposed renewable energy source distributions, transportation programs, solid waste management programs, etc.

See Appendix F for the complete CLEAR Analysis and Modeling Report.

Figure 11 shows the interface Main Page view, where the user defines their own scenario. Figure 12 shows the interface Economic impacts view for the chosen scenario. The user can run different scenarios and compare the results.

Figure 11: CLEAR Model Interface Main Page

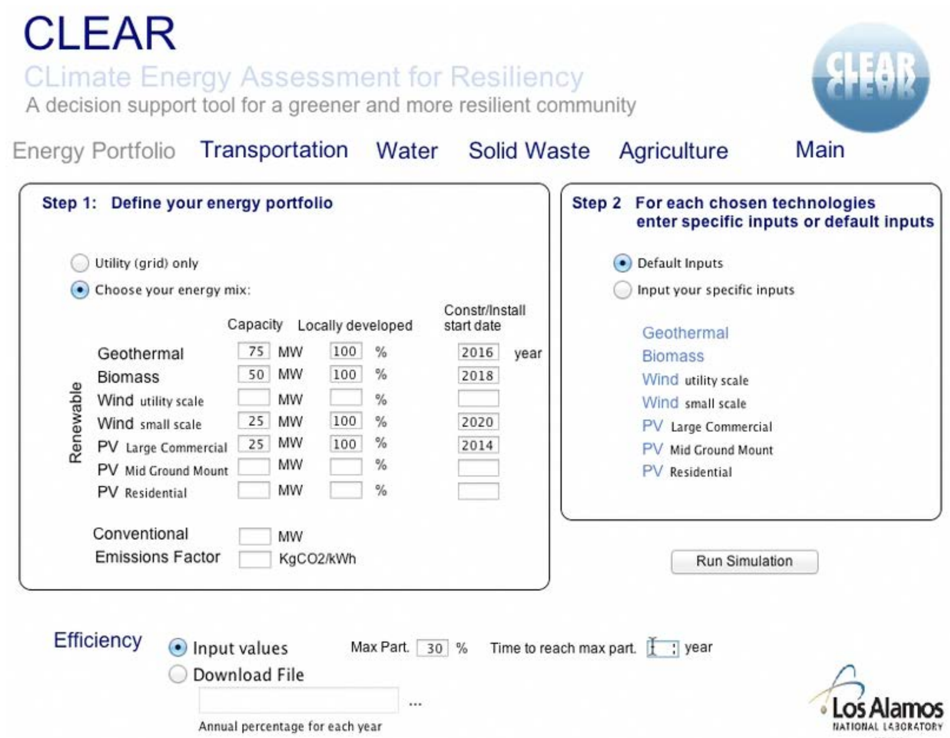
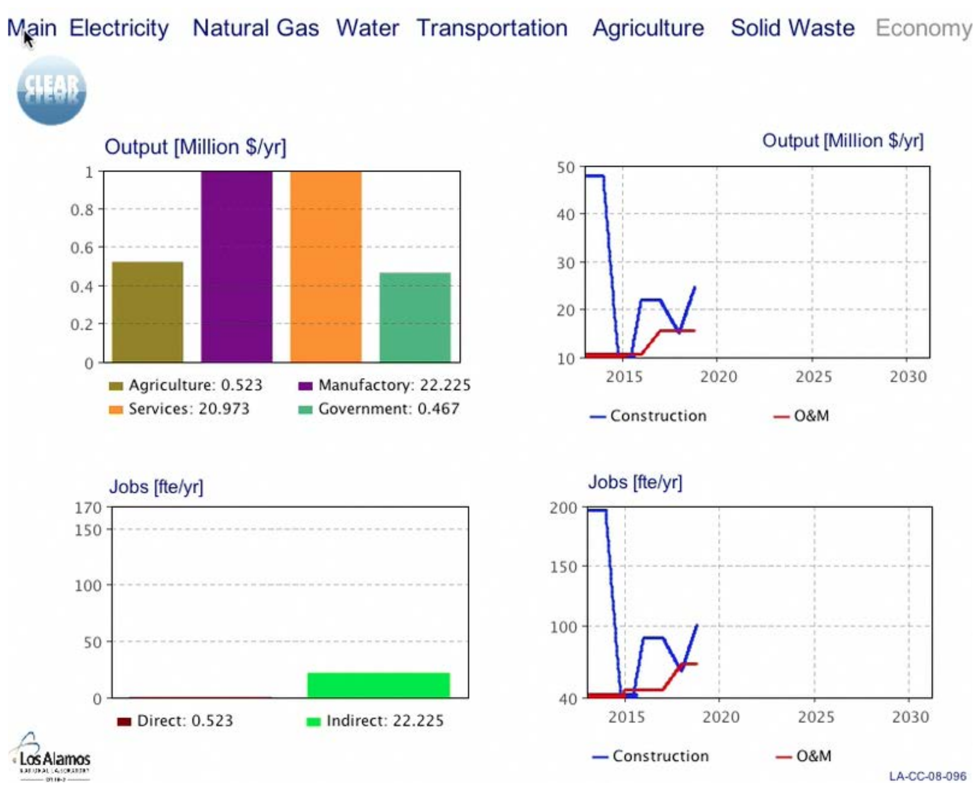


Figure 12: CLEAR Model interface Economic Impact Outputs

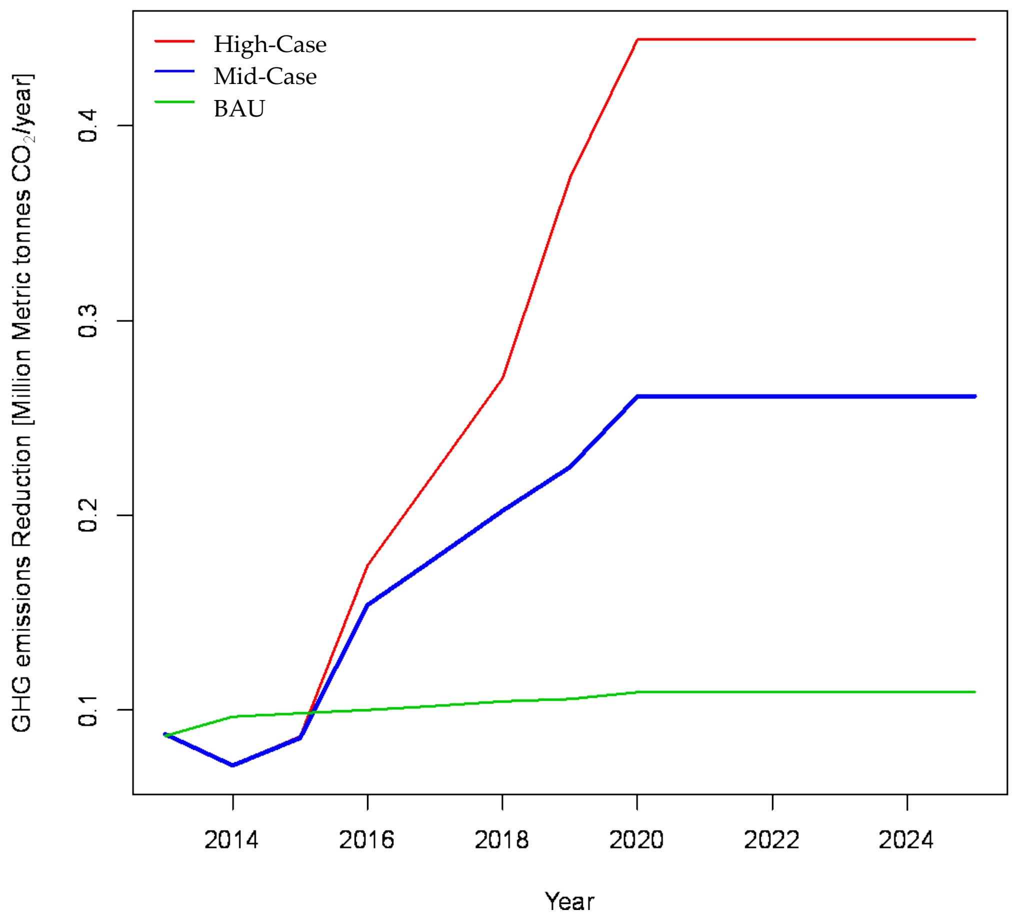


5.3.2 CLEAR Model RE Portfolio Results

The three RE portfolio scenarios were run in the CLEAR model to determine GHG and economic impacts.

Figure 13 shows the comparative GHG Emission reduction amounts from each of the scenarios. The figure shows that while the BAU case may result in more emissions reductions in the first few years of implementation, the Mid-Case and High-Case scenarios drastically improve on GHG reduction into the future. This is due to the focus on time intensive planning, design, financing and construction efforts that must take place to implement utility scale local renewable projects compared to just BAU customer side net metering projects. The Mid-case scenario approximately doubles the savings by 2020 while the High-Case scenario more than triples the savings.

Figure 13: CLEAR Results- GHG Reduction for RE Portfolios 1, 2, and 3, (BAU, Mid-Case, and High-Case Scenarios)



Figures 14-16 demonstrate the economic impacts of each of the scenarios as modeled in CLEAR. For each of the scenarios, the following outputs results are presented:

- Total Jobs
- Total Output- local spending as a result of new jobs during the construction and operations periods

Figure 14: CLEAR Results- BAU Scenario

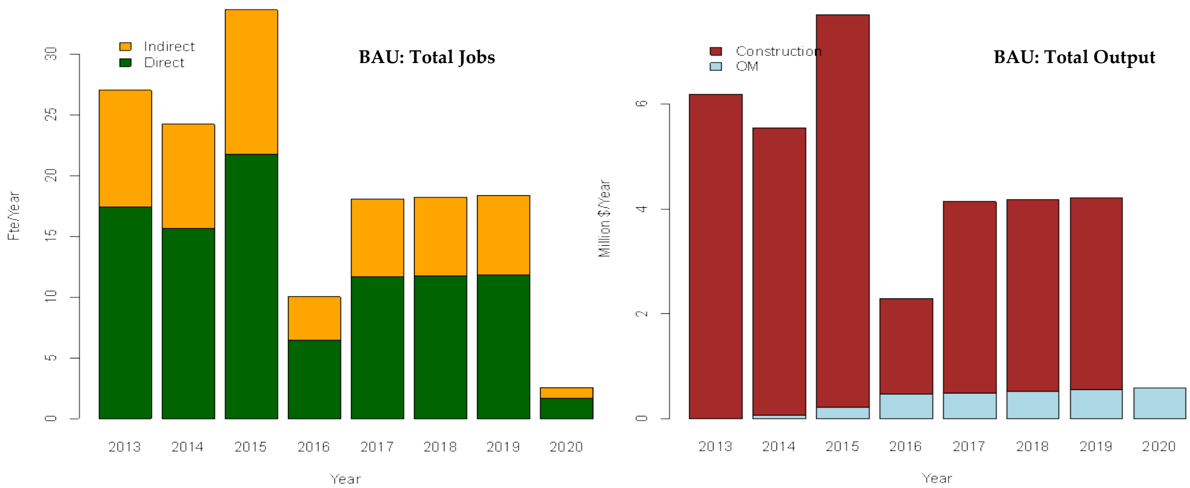


Figure 15: CLEAR Results- Mid-Case Scenario

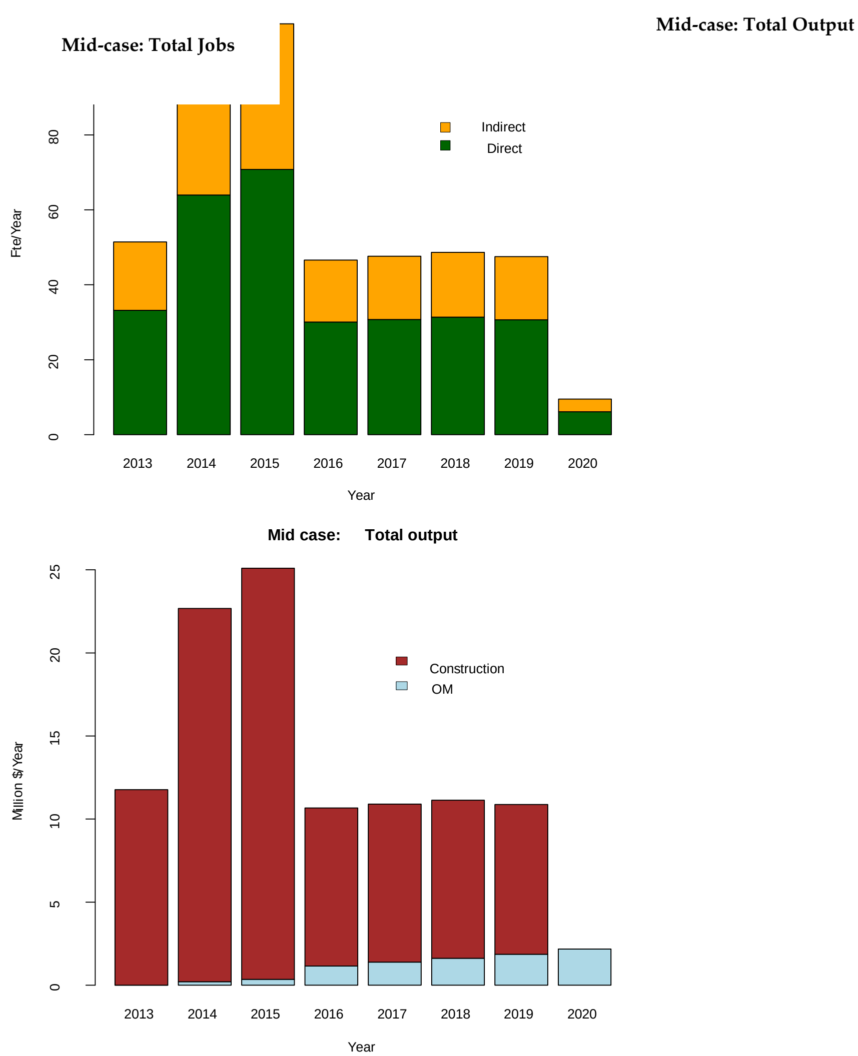
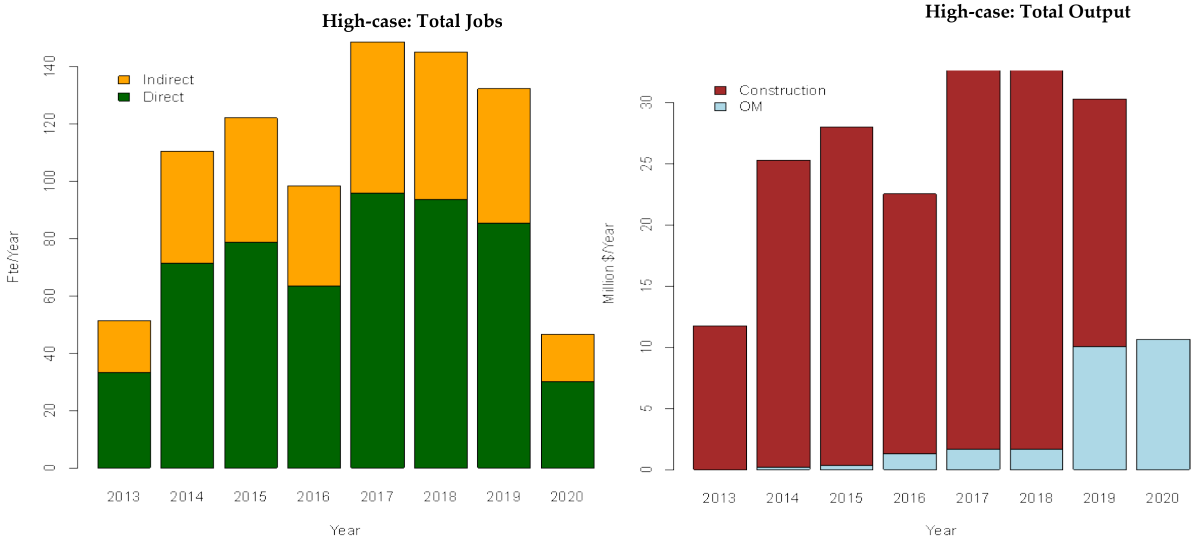


Figure 16: CLEAR Results- High-Case Scenario



CHAPTER 6:
Pilot Project Design and Construction

6.1 Scope

The goal of this task was to design and build chosen representative mix of RE technologies within the RE portfolio to assess performance capabilities.

The purpose of the demonstration pilot projects was to:

- Develop and demonstrate functional, cost effective projects that are integrated, co-located, utilize mature renewable energy resources and display the potential for micro-grids at other sites in the county.
- Provide technical, cost, geographical, industrial and cultural implications of the design process such that future county renewable energy projects can benefit from the experience and processes that the Water Agency used to implement these projects.
- Indicate barriers that need to be addressed for county-wide implementation.
- Coordinate data and design development from the pilot project to inform the renewable energy (RE) portfolio and the system dynamics (SD) model developed in other tasks of the overall RESCO project.

The pilot projects will serve as “proof of concept” in creating energy regions less dependent on the utility-based electricity and natural gas transmission system.

The Pilot Project Design Report is shown in Appendix G.

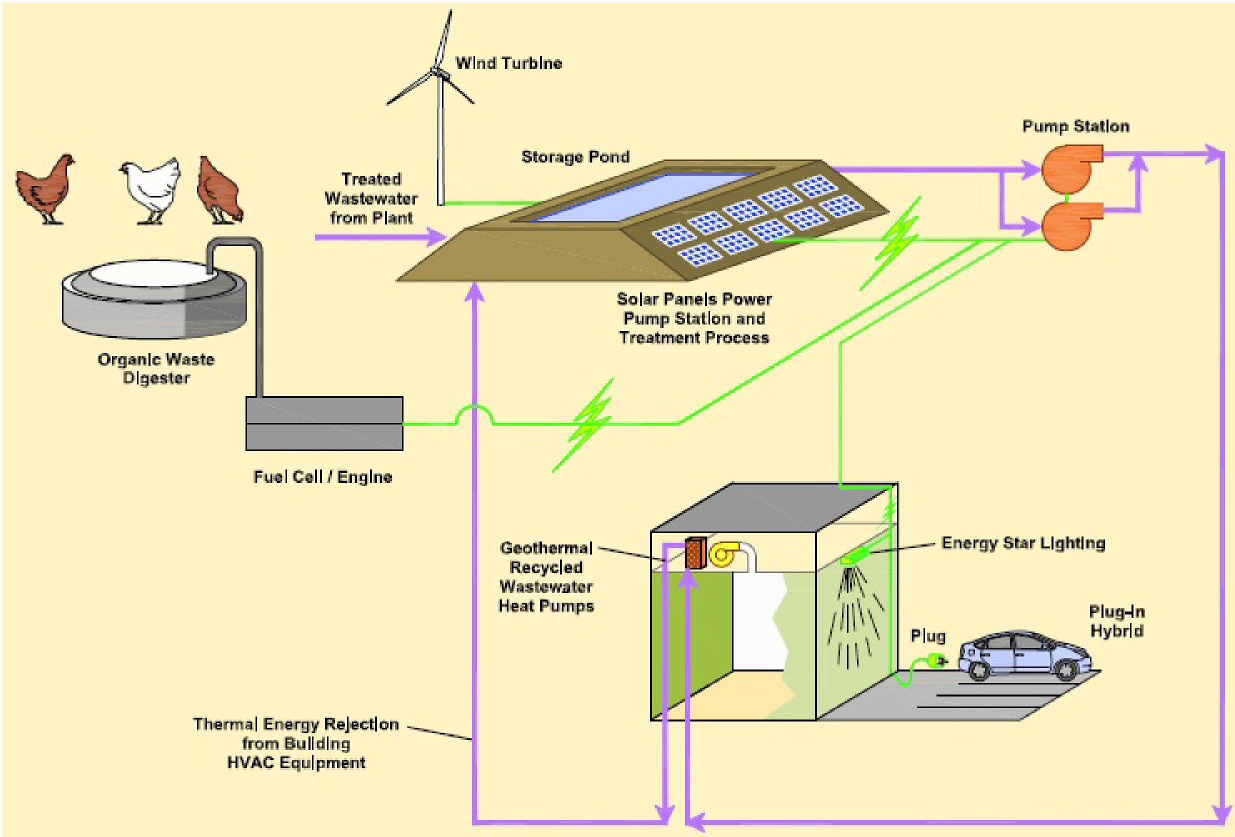
6.2 Project Design

Four pilot projects were designed and investigated at existing Water Agency locations as follows:

- Poultry manure digester and biogas combined heat and power
- Small wind energy technology
- Geothermal heat pump using tertiary treated wastewater as a “heat sink”
- Installation of electric vehicle charging stations

The design intent of the pilot elements was to demonstrate renewable energy microgrid at any of the Water Agency’s wastewater treatment plants including Airport Larkfield Wastewater Sanitation Zone (ALWSZ) as shown in Figure 17. Note there is an existing 500kW solar facility at the ALWSZ treatment plant.

Figure 17: Original Design Intent of Pilot Projects



The Farms to Fuel/biomass projects would provide base load power whereas the wind and solar projects would produce power based on times of wind and solar availability. Wind and solar typically coincide with peak demand at the treatment plant based on varying flows into the plant and the consequent power demand required to treat those flows.

While the original design intent was for all of the pilot projects to be located at the ALWSZ treatment plant, due to programmatic and economic feasibility considerations, the wind turbine project was relocated to the Geyserville treatment plant and the poultry manure digester was not constructed in the timeframe of this project.

The pilot projects constitute a small sample of county sectors (e.g., energy, transportation, water, economy, land use, agriculture). The individual technologies are flexible and scalable to a considerable degree and, if adjusted accordingly, could potentially meet foreseeable contingencies for local electricity needs.

Table 5 outlines the design intent energy production, GHG savings, cost effectiveness and scalability of the pilot project RE portfolio.

Table 5: Pilot Project Technologies Outputs and Potential Scalability

	Project	Capacity (MW)	kWh produced/ saved	GHG savings (metric tons CO_2)	$/ metric ton abated	% of total Water Agency Use	% of total County Energy Use
RE Projects	Farms to Fuel	1.4	12,264,000	9,477	$ 4,326	32%	0.44%
	Wind	0.005	8,203	1.7	$ 17,816	0.02%	0.00%
	Solar	0.5	789,033	159	$ 15,383	2%	0.03%
	Total Pilot Project RE Portfolio	**1.905**	**13,061,236**	**9,638**	**$ 4,511**	**34%**	**0.47%**
Emission reductions projects	Geothermal Heat Pumps	Efficiency Measure	9,067	1.8	$106,545	Efficiency Measure	
	Electric Vehicles	Overall emissions reduction only, no energy production		4.65	$ 719	Overall emissions reduction only, no energy production	

The total County load based on Task 4 Data Integration Report, Table 2.

Solar cost effectiveness based on $4.90/W for commercial systems >100 kW in California. Tracking the Sun V: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2011, Lawrence Berkeley National Laboratory, November 2012, Figure 18.

6.3 Project Construction

As mentioned previously, the wind turbine project was relocated and constructed at the Geyserville wastewater treatment plant and the poultry manure digester will not be constructed in the timeframe of this project.

The construction of the geothermal pond loop and the electric vehicle charging stations are underway at the ALWSZ Treatment Plant, where there is already an existing 500 kW solar array.

6.3.1 Geyserville Wind Turbine

The 5 kW wind turbine was installed at the Geyserville Treatment Plant January 3, 2013. Figure 18 shows the assembly and installation of the turbine including the inverter, transformer and load bank. The wind turbine is currently generating electricity, however final commissioning and contractual obligations will not be complete by the time the RESCO contract expires.

Figure 18: Wind turbine Assembly and Installation

6.3.2 Geothermal Pond Loop and EV Charging Stations

Construction of the new ALWSZ Treatment Plant Service Center will include a geothermal pond loop for heating and cooling the building and two electric vehicle charging stations. Construction began in Fall 2012 and is expected to be complete Spring 2013.

Figure 19 shows the building in construction. The two electric vehicle charging stations will be located at the parking spaces adjacent to the side of the building shown in the Figure.

Figure 19: ALWSZ New Service Center Construction

Figure 20 shows the charging stations that are located at the Water Agency's Administration Building which will be similar to those installed for the Service Center. The Administration Building is currently a net exporter of electricity and as the vehicle fleet transitions to EV's, the Water Agency's reliance on external sources of fossil fuels will transition to reliance on autonomously secure local renewable energy sources such as solar PV.

Figure 20: EV Charging Stations at Administration Building

Trenching for the pond loop and pipe guides that will hold the insulated pond loop piping in place down the incline of the pond have been constructed as shown in Figure 21. The pond loop coil and frame, connection to heat pumps, starting and testing has yet to be completed. Completion is expected in Spring 2013.

Figure 21: Pond Loop Trenching Concrete Pipe Guides

The following figure shows another location with a similar, but smaller pond loop. Figure 22 shows the pond loop before submergence.

Figure 22: Example of Pond Loop Before Submergence

CHAPTER 7: Technology Transfer

7.1 Scope

The goal of this task was to develop a plan to make the knowledge gained, experimental results and lessons learned available to key decision-makers.

7.2 Plan

The Technology Transfer Plan included:

- Posting key project documents and reports including the Technology Transfer Plan on the SCWA [RESCO] website
- Conducting workshops and presentations to facilitate technology transfer to interested communities
- Providing design/application guidelines developed during the project
- Arranging and conducting walk through tours of the pilot project.

Water Agency presented the Sonoma County RESCO project or elements of the project at many venues throughout the project including:

- California Agricultural Board: Organic Waste Digestion / Fuel Cell Project, May 25, 2010
- California Environmental Dialogue: Opportunities and Challenges of Local Renewable Distributed Generation, August 2010
- California Hydrogen Business Council: "New Technologies and Hydrogen from Renewables," October 2011
- Water Agency Board of Directors: RESCO Update, December 2011
- Congressman Mike Thompson: RESCO Introduction, January 2012
- Applied Solutions Webinar: Creative Approaches to Clean Energy Financing, January 2012
- Energy Commission staff: RESCO Update, March 2012
- Growing Sustainable Communities Conference – Western Regions: Farms to Fuels Update, May 2012
- Energy Commission staff: RESCO Update, September 2012

The Technology Transfer Plan is shown in Appendix H.

The Sonoma County RESCO website is http://www.sonomaresco.org/.

CHAPTER 8: Conclusions

Sonoma County can meet a large portion of its forecasted electricity demand through development of local distributed and small scale renewables, combined heat and power, biomass, and demand reduction resources such as energy efficiency, with substantial participation from the private sector and application of the right financing structures. Local renewable-based energy resources could be developed through a more comprehensive locally controlled community choice aggregation program or other similar program. The cost-effectiveness of meeting this demand is likely to improve over time as the costs of wholesale energy and corresponding retail electric rates increase.

While the goal of this project was to develop an RE portfolio that refined the Sonoma County Community Climate Action Plan portfolio to an extent that would be ready for implementation, barriers were encountered that led the RE portfolio to require further actions to bring it to this advanced stage. The barriers and lessons learned from this project provide valuable insight and recommendations to other communities exploring local energy independence.

8.1 Lessons Learned/ Recommendations

8.1.1 Data Collection

In regards to utility data collection, AB 117 requires utilities to cooperate fully with CCA data requests specifically. PG&E's current CCA-INFO tariff excludes the following:

- Natural gas data for customers within the jurisdiction(s) of the agency
- Utility distribution impedance maps
- Substation and transmission system data and all meters for PG&E transmission and distribution system serving the local government agency

During the data collection phase, PG&E was not able to provide any data not covered by its Schedule E CCA-INFO tariff. Because CPUC regulations provide that a local government, not an investor-owned utility, may decide what constitutes appropriate data under AB 117 regulations, communities interested in further refining their RE portfolios beyond electric power needs could consider petitioning the CPUC for modifications of PG&E's CCA-INFO tariff. The CPUC should be made aware of this gap in data needed to analyze at a very small, local scale. The CPUC should then amend the tariff to include the necessary data. Note that towards the end of the project, the Public Utilities Commission adopted a decision pursuant to SB 790 requiring utilities to provide necessary data as requested by any communities pursuing community choice aggregration.

Specifically, PG&E's tariff should be changed to allow for (1) permanent real-time 24/7 data access to PG&E's entire database for every meter and measuring device in or near Sonoma County; (2) any form of data including the entire contents of the PG&E database, at cost; and, (3) natural gas data to the greatest detail allowed by law and regulation.

The strategy for requesting and obtaining data from public sources should be planned in advance for best results. In the case of Sonoma County, an overall survey of the available data would have been a valuable step. Rather than determining in advance what data would be required and making a blanket request of all cities and the county, a survey of available data starting at the state level would have been more immediately productive.

Once a survey is completed of countywide data available from government entities, a more customized approach to identifying city-specific data can be undertaken. Generally, city-specific datasets are best obtained by personal contact, starting at the City Manager level. California state government, in particular, the Energy Commission, can provide essential infrastructure data, including transmission line and substation locations, natural gas pipelines and the like. Although subject to security controls, these datasets are relatively easily obtained by government entities. The Commission also maintains datasets related to the regional availability of renewable energy resources.

8.1.2 RE Portfolio Design

Barriers exist to increasing the amount of local renewable energy that can be integrated into a community electric energy supply. These barriers include factors such as cost and other financial issues, challenges with generation profiles (for example, intermittent availability of solar and wind power), limits to the architecture of the local distribution, lack of access to high resolution local demand profiles, limits of local resource availability, regulatory and institutional barriers, and political challenges, as well as risk-averse attitudes and limited knowledge about how to accomplish high levels of local renewable energy.

Recommendations for increasing the amount of local renewable energy include the following:

- Establishing a community choice aggregation program, or similar program, to provide planning and financial tools for implementing portfolios with high penetration of cost effective local resources.
- Implementing financial tools, such as on-bill financing, feed in tariffs based on market conditions not flat or average rate, and low interest loans, to expand deployment of energy efficiency and on-site distributed generation behind the meter
- Removing restrictions that prevent biomethane in natural gas transmission pipelines to qualify as a renewable energy resource, which would improve the cost-effectiveness, flexibility, and efficiency of using this fuel.

Further recommendations include:

Methodology and Approach

- Continue work to identify and develop site specific opportunities for distributed generation based upon the further application and refinement of resource availability as well as energy use patterns and load volumes in different neighborhoods and municipalities in Sonoma County
- In the case of combined heat and power, obtain natural gas data to update and expand analysis locations where both heat and electrical power demand coincide at a large enough scale to merit consideration
- Continue to utilize the CLEAR model to assess the economic and carbon impact of new renewable energy projects

Local Renewable Energy Supply Portfolio

- Adopt program targets for developing local resources, including on-site generation for residential and commercial customers, energy efficiency, energy storage, and demand response.
- Continue to develop on-site self-generation using solar PV and CHP that is placed "behind the meter" in order to increase the value of these resources, and to reduce the cost for a CCA to expand local RESCO resources
- Coordinate strategies to significantly reduce project costs using financing tools and deployment strategies
- Raise the statewide net-metering cap to increase the amount of distributed generation that can be built; however, a CCA is not limited by net metering, and can use a net-surplus feed-in tariff to compensate excess electrical generation that is not consumed on-site

Local and Site Specific Supply Resources

- Conduct actual site measurements and data collection such as anemometer studies for wind, test well drilling for geothermal resources, and assessment of specific biomass feedstocks

Community Scale Electric Demand Analysis

- Obtain detailed hourly load profile information at the substation level, distribution feeder characteristics, and supervisory control and data acquisition (SCADA) information that relates to substation or distribution system operation through the E-CCAINFO tariff

Demand Side and Load Balancing Resources

- A robust energy efficiency program in Sonoma County will require evaluating the program scope, identifying cost-effective implementation strategies, and developing local administrative capacity
- Perform an assessment of how local administration would align with the CPUC's recent goal to have a consistent and streamlined regional marketplace under the Energy Upgrade California brand
- Coordinate closely with PG&E's incentive process to integrate CCA into the statewide whole-house incentive program
- Expand access to financing options for efficiency improvements, including PACE, on-bill financing, feed in tariffs, use of CCA procurement funds, available subsidies, as well as bank loans and public bonds

Financing

- Set up programs that provide access to low interest financing for local and distributed generation, using public issuance of bonds, loan guarantees to support traditional loans, or through special loan programs for small scale renewable energy projects
- Establish a State level program that supports the ability of CCAs to issue bonds to finance and build local renewable energy projects

8.1.3 Demonstration Pilot Projects

Farms to Fuel

Due to unforeseen barriers, the Farms to Fuel project did not move forward in the time frame outlined in the Water Agency/ Energy Commission RESCO contract. The barriers experienced for Farms to Fuel should be used as lessons learned and considered before implementing similar projects within the state.

A significant barrier in consolidating a central power generating facility on one site with fuel is the restricted incentives by the California Public Utilities Commission's (CPUC) Self Generation Incentive Program (SGIP). As the program currently stands it caps the financial incentive based on the electrical load at the site. The Water Agency plans to transmit a portion of the power generated to serve combined electrical loads of off-site facilities owned and operated by the Water Agency. A centralized power plant would result in greater system efficiency, lower capital costs, and fewer environmental impacts than distributed plants. Centralized renewable power plants would offer the same benefits to other Agencies and end users statewide and should not be financially disadvantaged from decentralized renewable power plants.

Also in January of 2011, the CPUC suspended the SGIP program making a key funding source uncertain while the project was being developed. The CPUC allowed the program to resume in November of 2011, but with lower incentive levels for fuel cells and with new incentive levels for other cogeneration equipment such as engines and microturbines. The project assumed fuel cell incentives would be sustained at the same levels, so the environmental documentation and conditional use permit explicitly spelled out a fuel cell as the cogeneration device. So these key documents would need to be revised to make the project more favorable economically for the developer. Additionally, knowing the cogeneration equipment could be less expensive than a fuel cell, the Water Agency wanted to renegotiate the Power Purchase Agreement, which expired at the end of March of 2012, with a less expensive unit power price. Changing the environmental document would require notifying the public of those changes and re-approval of the revised environmental document and conditional use permit by multiple authorities.

In addition to the CPUC incentive program barriers, financial markets in both the bond market and private markets have not been favorable to borrowers the past few years. OHR Biostar considered financing environmental consultants to prepare required permitting applications for Army Corps of Engineers and US Fish and Wildlife permits. But without financing secure, OHR Biostar opted not to pursue these permits. Without these permits in place, construction cannot begin in calendar year 2012. Without construction beginning this year, the project will not be producing power by the end of calendar year 2013, which is one of the criteria for remaining eligible for the 1603 US Treasury tax credit for renewable energy projects as a grant. Without that grant, the project would struggle to remain economically viable based on comparisons to current electrical power prices. As such, OHR Biostar has not devoted much effort in the project since the end of 2011.

Though Farms to Fuel will not be constructed in Sonoma County within the timeframe of the RESCO project, there is still valuable information to be derived out of the pilot project OHR Biostar is conducting in Butler, Missouri for the project. The pilot project facility demonstrates that the OHR Biostar thermophilic anaerobic digestion process and fertilizer production is a viable means of converting chicken manure into useful product. The pilot project Progress Report Issued September 20, 2011 by MRIGlobal states:

> *"The AD system maintained stable operation over a 4-month period utilizing only poultry manure as feedstock. Biogas with methane content between 55% to 63% was produced at a rate between 2.0 and 3.5 slpm."*

Wind Turbine

The barriers, challenges and successes experienced for the Geyserville wind project should be used as lessons learned and considered before implementing similar projects within the county and state.

Financial and payback models that include incentive rates must be carefully considered. The pilot project wind turbine cost effectiveness originally included an incentive rebate from the Energy Commission Emerging Renewable Program. Due to the suspension and restructuring of the program caused by false reporting of turbine performance on other projects, the rebate was no longer available for the project. The original wind turbine contract had to be terminated and a new project with a reputable wind turbine yielding good financial payback and emissions reduction had to be selected. Careful selection and scrutiny of wind turbine and performance is essential in delivering a project that meets energy production claims. Timely implementation of a project application and approval under rebate incentive programs must also occur to ensure that any rebates included in a cost effectiveness model are actually realized.

Site selection is essential in terms of wind resource, constructability, and emission and financial savings potential. Using publicly available wind resource maps help in the initial identification of potential site areas. Using anemometers (wind measuring devices) to verify the wind patterns at a specific site provides a more accurate estimate of the energy production that can be expected. Sites should be selected with no obstructions that will affect wind flow, in appropriate local zoning areas, in areas with positive community involvement and in areas that can be accessed for maintenance and installation.

In addition, it is advisable to follow practices and guidelines for implementing large land-based wind systems when implementing small wind systems, such as conducting avian and bat surveys to determine potential impacts prior to selecting a site. The Water Agency will be monitoring bird and bat mortality at the site and this would be an essential activity at any site that implements small wind power.

Geothermal Pond Loop

The barriers, challenges and successes experienced for the new Service Center geothermal heat pump project should be used as lessons learned and considered before implementing similar projects within the county and state.

The cost effectiveness of this project is lower than the pilot RE projects. It is also a project that does not generate renewable energy, but instead reduces the demand for heating and cooling energy. The infrastructure required for a geothermal heat exchange pipe network is very costly and requires a large physical area (either vertically or horizontally). A geothermal pond loop for this project was feasible only because there was an existing water source relatively nearby. The pond and the pond loop have life expectancies well beyond 50 years, which allows subsequent replacement of mechanical equipment cost effective and the geothermal heat pump system a viable resource for future retrofits of the Service Center. The plant does not currently have natural gas service, so adding that service helped bolster the economics for using heat pumps. The site should also have high heating and cooling loads for it to be cost effective.

Site selection for geothermal heat exchange projects should either have an existing water source in very close proximity or a large area of land that can be used for vertical drilling or horizontal layout of piping. If the source pond were large enough and close enough to groups of buildings with high energy consumption, one pond could serve multiple buildings. The Water Agency explored early in the project the feasibility of developing recycled water infrastructure and using that recycled water infrastructure for geothermal heat pump use. But building density in the business park around the pilot project site was not large enough to make a regional heating and cooling loop cost effective. The regional climate in the business park is temperate and therefore the heating and cooling costs are relatively inexpensive making a regional heating and cooling loop not cost effective. The amount of water required to be circulated to operate a heating and cooling loop in a business park of this size would be approximately three times larger than the amount required for a recycled water distribution system. Also, a regional heating and cooling system would require a supply pipe and a return pipe and an increased pump station size. So doubling up duties of recycled water system and a regional energy loop is not practical.

See Appendix I for regional geothermal exchange analysis.

8.2 Benefits/Adaptability to California

Projects such as this that further investigate and provide leadership in creating efficient, integrated, distributed renewable energy-based electricity can drive actual projects to emerge and increase in presence in the electrical grid.

The Sonoma RESCO RE Portfolio presents a new, localized energy infrastructure model that provides environmental and economic benefits for California's electric bill payers in the following ways:

- Reducing the cost of electricity for ratepayers on a long-term basis: Renewable energy is primarily tied to an upfront investment. Once the initial investment has been made, the cost of energy is stable over time and ultimately becomes less when compared to fossil sources that are likely to become more expensive as these sources are depleted.

- Stabilizing rates in the near term: Long-term contracts lock in energy supply prices that are relatively predictable over time, thus enabling suppliers and administrators of local energy programs to offer more stable retail rates.
- Providing local economic benefits and jobs: The RE portfolio described includes new local infrastructure that requires a workforce to build it. Those local jobs not only employ people, but those employed people induce additional economic activity in the community as outlined by the CLEAR model.
- Expanding private enterprise opportunity in the energy sector: A community choice aggregation program, the most likely governance structure to administer a RESCO-like portfolio, has the authority to establish policies that can incentivize businesses of any kind to invest in clean energy generation such as solar photovoltaics on warehouse rooftops.
- Enhancing energy security and independence: Localization of generation, combined with local control of that generation, releases local governments and communities from dependence on distant decision-making and distant power supply.
- Increasing local control and community participation: The local RE portfolio implementation depends on local government engagement. Because a CCA is a public entity, greater public participation is likely in energy policy decision-making.
- Offering a model mechanism for California to achieve its GHG reductions goals: Lacking federal or state level policy mechanisms that strongly incentivize renewable deployment pursuant to State goals, responsibility for action goes to local governments. In fact, representatives of the Governors' office have stated explicitly that the Governor expects local governments to play a lead role in achieving the State goals.
- Helping to achieve California State energy goals: California has set a goal that 33 percent of the State's electricity be derived from renewable energy sources by 2020. That goal does not define all of the necessary policy mechanisms or programmatic models. The RPS for 2010 was 20 percent and none of the State's IOUs achieved the target by 2010. In 2011, a year late, two of the state's major IOUs — SCE and SDG&E — achieved the target, while PG&E was just shy of the target.

The state also has policy goals for specific renewables that Sonoma County should contribute toward. The RE portfolio Scenario 3 contributes to Sonoma County's pro-rata state policy goals (Table 6).

Table 6: RE Portfolio Contribution to State Renewables Goals

	Resource	Portfolio 3 Capacity	Pro-Rata Policy Goal	Match State Goals?
		MW	MW	
1	Efficiency	142.0	142.0	Yes
2	Solar PV (GoSolar/CSI)	85.0	31.0	Exceed
3	NG CHP	40.0	40.0	Yes
4	Geothermal	70.0	N/A	N/A
5	Biomass	30.0	30.0	Yes
6	Wind	25.0	N/A	N/A
7	Hydro	2.8	N/A	N/A
8	Storage	30.0	30.0	Not Adopted
	Total	424.8	273.0	

Finally, the system dynamics model (CLEAR) was developed not only as a model but also as a tool for other local communities. The model user interface and the particular modeling approach enable the direct use of CLEAR by policy makers and stakeholders supporting them in making decisions regarding the implementation of climate change mitigation actions

GLOSSARY

Term	Definition
AB 117	California State Assembly Bill 117 (AB 117), passed and signed into law in 2002, gave California cities and counties the ability to aggregate the electric loads of residents, businesses and public facilities to facilitate the purchase and sale of electrical energy in a more competitive market.
BAU	Business as Usual
CCA	County Community Choice Aggregation
CCAP	Community Climate Action Plan
CHP	Combined Heat and Power
CLEAR	CLimate-Energy Assessment for Resiliency
CPC	Climate Protection Campaign
CPR	Critical Project Review
CPUC	California Public Utilities Commission
CEQA	California Environmental Quality Act
GHG	Greenhouse Gas
GIS	Geographic Information System
IOU	Investor Owned Utility
LANL	Los Alamos National Laboratories
RCPA	Regional Climate Protection Authority
RD&D	Research, Development, and Demonstration
PIER	Public Interest Energy Research
RE	Renewable Energy
RESCO	Renewable-Based Energy Secure Communities
SCADA	Supervisory Control and Data Acquisition
SCWA	Sonoma County Water Agency
SGIP	Self Generation Incentive Program
Smart Grid	Smart Grid is the thoughtful integration of intelligent technologies and innovative services that produce a more efficient, sustainable, economic, and secure electrical supply for California communities.
TOU	Time of Use

LIST OF APPENDICES

These appendices are available as separate volumes, publication numbers

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